which was great fun. But at some point I realized that it was not brain research. At that time *Drosophila* with its potent genetics was just about to go molecular. And flies have brains. I hoped for a while that I could understand fly brains just as chemists understand their molecules. I was still young, I was determined not to get trapped by the mind–body problem.

Do flies have feelings and a world model? I soon realized that, even with the smallest animal, studies of brain function can not avoid the mind–body problem. I started out with the visual system. Does a fly see? If so, what does it see? Infinite confusion. But you asked about feelings: we have access to the feelings of our fellow humans primarily by empathy. We assume others feel like us. This sharpens our perception of the differences and uniqueness of the other. With animals the empathy approach does not fully work. They are just too different.

But what — if anything — of what we know about human feelings applies to flies? Science treats these 'mind questions' always in the same manner: we first have to establish a catalogue of objective criteria going along with our own feelings. (Just to have the feelings is not enough.) With this catalogue we are then in the position to investigate which of the criteria also apply to the fly. Finally, we have to decide whether to call it the same or not. But do not forget, we are talking about criteria accompanying the feelings, not the feelings themselves.

You still haven't answered the question! Flies show signs of pain and avoid the smell of dead flies (as if they had fear); they fight with other flies and their courtship is motivationally regulated. For the other mental phenomenon you mentioned, the experience of a 'world model', a catalogue of objective criteria has yet to be worked out.

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Feature

Frozen ark to hold samples of endangered species

A new project hopes to save something for posterity from dwindling species. **Nigel Williams** reports.

A new repository, aiming to be a modern version of Noah's Ark, has been designed to save DNA and tissue samples from thousands of creatures facing extinction. Launched by researchers at Britain's Natural History Museum in London, the project was set up to preserve material from a vast array of animals under threat of imminent extinction because of human actions. Thousands of species are under threat within the next few decades because of pollution, war and habitat destruction.

Scientists behind the project, dubbed the Frozen Ark, are keen to preserve the DNA and tissue samples of endangered animals so they can continue research into their evolutionary histories even if they become extinct. The project is supported by the museum, the Zoological Society of London and the Institute of Genetics at the University of Nottingham. More ambitiously, scientists hope one day that the material may be useful in cloning techniques.

"Because of man's actions, species are going extinct at an alarming rate. We're losing them now at a rate that's as serious as the great extinctions," says Philip Rainbow of the Natural History Museum.

"The ultimate desire is that if we keep tissue samples, we can one day implant these into surrogate parents and get them back. It may sound fanciful, but it'd be a great pity if in 40 years' time scientists are saying, 'look what we can do now, why didn't you keep tissue samples of these animals?'."

Last month, DNA samples from the scimitar-horned oryx, which was declared extinct in the wild last year, became the first to be deposited, along with samples from the Socorro dove, a coral fish called the banggai cardinal, the yellow seahorse and the mountain chicken, which is actually a Caribbean frog (see box).

Other species will follow shortly, including the Polynesian tree snail,

Box 1

First entrants into the frozen ark.

The scimitar-horned oryx
Named after its scimitar-shaped horns, the oryx used to range throughout northern Africa. Overhunting, desertification and continuing wars in Africa have all contributed to its decline. It was declared extinct in the wild last year and exists now only in specialised breeding programmes in captivity.

The Socorro dove
Unique to Socorro, a remote island off the west coast of Mexico, the Socorro dove has been in decline since 1957 because of habitat loss and the introduction of domestic cats. The birds are now being bred in captivity and plans are in place to reintroduce them to the wild if their habitat can be made safe.

The mountain chicken
This Caribbean frog survives only on the islands of Monserrat and Domenica. The population was hit badly by the Monserrat volcano eruption. On Domenica, it suffered from being a prized food confounded by a devastating skin fungus epidemic. It is now being bred in captivity.

The banggai cardinal
This fish just measures a few centimetres in length, black and white in colour, living on only a small region of coral reefs. The species is threatened by over-collection by the pet trade.

The yellow seahorse
This is endangered because of its appeal to aquarium owners and its use in Chinese medicine. The species is now being bred in captivity in the hope of restoring numbers in the wild. Females lay their eggs in pouches on the male's belly and the male later releases live young.

the Fregate island beetle of the Seychelles, which is considered critically endangered, and the British field cricket, of which fewer than 100 remain in the wild. In the next 30 years, scientists predict that more than 1,100 mammals and 1,000 bird species will become extinct.

Not all the samples will be stored at the Natural History Museum. Part of the project will involve the creation of a database that holds worldwide information on DNA and tissue samples. As an insurance against damage or loss of the frozen samples, duplicates will be kept in chosen institutions around the world.

The Frozen Ark is possibly the best chance of being able to ensure that, even if certain species are wiped out in the coming decades, they may not be lost for ever, says Rainbow. "It may sound depressing that we feel we have to do this, but it would be even worse if we did nothing," he said.

"Natural catastrophes apart, the current rate of animal loss is the greatest in the history of the earth and the fate of animal species is desperate," says Rainbow. "Progress in molecular biology has been so fast that we cannot predict what extraordinary things may be possible in the next few decades. For future biologists and conservationists and for the animals they seek to protect this global network will be of immeasurable value."

Losing out: The scimitar-horned oryx has been declared extinct in the wild last year. Its only hopes are captive breeding projects and a new plan to store DNA and tissue samples for future use. (Picture: Photolibrary. com.)

Quick guide

Tribolium

Martin Klingler

Not to be confused with..
Tribolium castaneum, the red flour beetle, is often confused with *Tenebrio molitor*, the common 'meal worm' found in pet shops. Although morphologically similar to *Tenebrio*, *Tribolium* is much smaller and even easier to breed. That's why this beetle was used by population geneticists for decades before it was rediscovered as a system in which embryonic development, and other biological phenomena such as pesticide resistance, can be genetically analysed. The ease with which it can be manipulated, its taxonomic position, and the fact that it is a representative of the largest animal order, were the main reasons why last October *Tribolium* was selected by NHGRI to be included in its list of species that will have their genomes sequenced in the near future.

Where does it come from? As a major pest of stored grains and grain products, *Tribolium* spread around the world with human agriculture. Dead beetles found in ancient Egyptian tombs are indicative of an Old World origin, but beyond that little is known about its place of origin or natural habitat. The strains used by *Tribolium* geneticists are derived from farms and commercial storages around the world. Their ability to live on dry food alone — metabolic water is the main source for their bodily juices — hints that these beetles evolved in a dry environment, but their original food source is unknown!

A better insect model system?
Tribolium has become a prominent subject for studies of the evolution of development ('evo-devo') because its mode of development is more 'insect-typical' than that of the classical system *Drosophila*. While both are holometabolous — they go